which the various systems of coordinates are considered is in some respects rather curious, *e.g.* tangential equations are not dealt with until the last chapter but one, after discussions on cross-ratios and involution and a chapter on invariants, the succeeding chapter being on covariants. After Miss Scott's brave and able attempt to introduce tangential coordinates to beginners, this seems rather a retrograde step.

Then areal coordinates are introduced before trilinears, because in the majority of cases the resulting equations are so much simpler than the corresponding trilinear equations. In spite of one's sympathy with the reasons, and one's pleasure in the author's treatment of areals, it seems a pity to depart from the historical order, which introduced the student first to abridged notation, which slid so naturally into trilinears, thus preparing the student for appreciating the greater simplicity of areals.

Indeed, in the present book the abridged notation that was so charmingly put in Salmon's treatise is to be found only in scattered places, with no great emphasis placed on it, at any rate until the fifteenth chapter. It is there, but it would need expert guidance for a student to appreciate it at its full value. In this respect, and in the treatment of reciprocation, Salmon's book should still be read. In fact, it is difficult to imagine a time when this incomparable treatise will cease to be a source of inspiration and a delight.

The great interest of the present book lies in its masterly treatment of innumerable problems, and the use that is made of determinants at every turn. The methods of the differential calculus are introduced as alternative to other methods, but are not made an essential part of the development of the subject, as one would rather have expected nowadays, when all scholarship students learn the elementary methods of the differential and integral calculus. Probably this subordination or avoidance of calculus methods is due to the requirements of the Cambridge course.

For scholarship work in schools, the better students could very profitably read a good deal of the earlier part, after they have mastered some easier book. In this respect it is somewhat like Dr. Hobson's invaluable treatise on trigonometry, only selected portions of which are within the range of reading of the majority of scholarship students.

## OUR BOOK SHELF.

*Formeln und Hilfstafeln für geographische Ortsbestimmungen.* By Prof. Th. Albrecht. Vierte Auflage. Pp. viii+348. (Leipzig: Wilhelm Engelmann, 1908.) Price 20 marks.

THE object of this work, which has run through four editions, is to supply within a convenient compass the formulæ that are used most frequently in the determination of time, and of terrestrial coordinates, together with tables by which the application of these formulæ can facilitate the ordinary work of an observatory. But the author has contrived that the book should be more than the mere collection of formulæ and tables. In an illuminating introduction he considers the sources of error which are likely to affect each class of observation, and uses his familiarity with different processes to show how many of these errors can be eliminated or rendered harmless by due precaution in the manipulation of instruments or by judicious selection of methods of observation. In this way the treatise becomes a practical guide in those matters of which it treats. These include the formulæ involved in the reduction of observations made for the determination of time, latitude, longitude, and azimuth. The instruments may be used on the meridian, on the prime vertical, or in the vertical of the Polar Star; they may be altazimuths or zenith telescopes; each finds its suitable application here; similarly, the particular methods which have been suggested to meet practical difficulties are discussed with the thoroughness of the expert.

The chapter on clocks contains much useful information to which Prof. Wanach, of Potsdam, has contributed. The tables of refraction have received special attention, incorporating the Pulkowa results. The numerical values, which very properly are not continued below 80° of zenith distance, may not differ greatly from those of Bessel, but they are founded on more modern theories, and with improved values of the refraction constant. As might have been expected from the author's long connection with geodetic work, references connected with the problems of the determination of longitude and the figure of the earth are particularly full. Indeed, in the latter section some of the tables can hardly be brought under the heading of "Ortsbestimmungen" as usually understood, but the tendency of all such compilations is to increase by the addition of tables and formulæ which have only a very limited application. Such tables have the advantage of being at hand if wanted.

It seems less defensible to cumber the book by other tables with which observatories are equipped quite as conveniently and with greater completeness in other forms. Those tables which give the squares of numbers up to 1000, or of the logs. of numbers up to 1960, or of trigonometrical functions of angles with no great accuracy, seem to us to be hardly warranted in a work of this character. But we hasten to say that this superfluity is not gained at the expense of material more immediately connected with astronomical work, and so far as we have been able to test the care and accuracy exhibited in the compilation, it is possible to speak in the highest terms.

*Human Speech, a Study in the Purposive Action of Living Matter.* By N. C. Macnamara. Pp. xiii+284. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1908.) Price 5*s.*

MAJOR MACNAMARA'S object in writing this book is to trace the gradual evolution of the living matter found in the cerebral centres on which intelligent speech depends. This is truly a herculean task, and one from which most physiologists and psychologists would shrink; and yet the author has succeeded in producing a readable book, full of information, and in many places both interesting and suggestive. There is not much said about human speech, either as regards its nervous or muscular mechanisms, but the author approaches the subject from the standpoint of general biology. He traces the influence of stimuli on living matter, the effects of the accumulation of stimuli, the gradual evolution of the senses, the corresponding development in greater complexity of the nerve centres, more especially of those connected with the higher centres of vision and hearing, and the changes that coincide with the appearance of such psychic activity as we associate with the brains of man and the higher animals. Waves of sound, falling on the ear, "reach the living matter forming his centre of hearing in such a form that they become impressed on this matter." The sensori-motor auditory centres become related

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to the living matter in the psychical areas of the brain, these react on the cerebral centre or centres for speech, and, in turn, these "play upon the nuclei of the nerves supplying the muscles of the vocal apparatus."

In supporting this thesis Major Macnamara shows a wide acquaintance with contemporary biology—indeed, to such an extent is this the case that the book can well be recommended as an introduction to this department of science. The only criticism that may be offered is that there is rather a redundancy of statement, and not infrequently an exposition of matters that are not quite pertinent to the subject in hand. As examples we may take the references to current speculations in physics, to Ehrlich's chain-theory, to the description of karyokinetic phenomena and the changes in the early ovum, and to the exposition of new and abstruse notions about reflex activity. No doubt the author has desired to take a wide and philosophic view of the whole subject, even at the risk of introducing matter somewhat irrelevant. Still, conciseness is a virtue worthy of cultivation. This is an excellent additional volume to the "International Scientific Series." The illustrations have been carefully chosen, and there is a good index.

J. G. M.

*Exercising in Bed.* By Sanford Bennett. Pp. 268. (San Francisco: The Edward Hilton Co., 1907.) Price 1.25 dollars.

IN the introduction to this book, the author explains that he had been a delicate child and had led a sedentary office life, so that at the age of fifty he was dyspeptic, his muscular system was flabby, he was prematurely old! By adopting the system of exercises detailed in the book, he claims that at sixty-seven he is a strong, healthy man, and has regained youthful vigour, and certainly the photographs reproduced illustrating his condition before and after treatment show a very marked contrast.

The author is an enthusiast, but the book is written in a moderate spirit which disposes to the acceptation of his views. He rightly claims that the functions of the body can only be carried on if they be used and exercised. Thus a gland or muscle condemned to inactivity atrophies; it is a physiological law that a certain degree of activity is necessary for the physiological integrity of an organ or tissue. In consequence various methods of physical culture are much in vogue, and are of considerable service in the development of the body and preservation of health, but tend to be unpopular owing to the time necessary to devote to them, and the individual who loves his bed cannot, or will not, rise early enough to carry them out. Mr. Bennett, however, declares that all the necessary exercises can be carried out while in bed, and we think he is right, and a quarter or half-hour may be well spent in healthy exercise without disturbing the ordinary routine. In some ways, in fact, the method has an advantage, as many muscles can be better exercised when lying than when standing, and in those who are getting on in years, perhaps with weak heart and diseased arteries, there is far less likelihood of over-strain. Combined with various movements, massage or rubbing of the muscles is advocated, and is very desirable.

A series of exercises is detailed in the book, illustrated in every case with photographs, by which the muscular system of all parts of the body may be exercised and developed, and most of them can be carried out without any extraneous apparatus. We have no doubt that the exercises suggested, if carried out, would be of considerable benefit, even if they did not actually rejuvenate or restore good looks, as the author claims.

R. T. H.

*Cement Laboratory Manual.* By Prof. L. A. Waterbury. Pp. vii+122. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd., 1908.) Price 4*s.* 6*d.* net.

THIS is a book for the use of students who are learning the various physical methods of testing cement. In the main it consists of instructions for working out a series of "problems" by the learner during a course of laboratory tuition, as practised in the University of Illinois. The work is arranged much on the lines familiar to students of electricity at Finsbury under the late Prof. Ayrton, the operators working in classes with given apparatus and materials, and being furnished with directions how to carry out the experiments, how to record the results, and how to interpret them.

For comparison of the results with what would be required in actual practice two useful appendices are given. One contains the report of a committee of the American Society of Civil Engineers on the question of uniform tests for cement; the other is a report upon standard specifications for cement, by a committee of the American Society for Testing Materials.

Determinations of the degree of fineness, specific gravity, plasticity, soundness, time of setting, and tensile strength of cements are the chief experiments set out. These are regarded as suitable for class teaching, and a student who works carefully through the exercises should gain considerable insight into what is required in judging the values of cements by laboratory tests. The author, however, rightly points out that a considerable amount of practice, much more than is afforded by the laboratory course, is necessary to obtain uniformly satisfactory results.

Theoretical matters are not dealt with in the book. There are illustrations of the chief pieces of apparatus, and also some trivial pictures—a mason's trowel, a set of scales and weights, and similar things—which are a mere waste of space.

C. S.

*"Saint" Gilbert: the Story of Gilbert White and Selborne.* By J. C. Wright. Pp. 90. (London: Elliot Stock, n.d.) Price 2*s.* 6*d.*

THIS little book bears a most unfortunate title, for whatever may have been the virtues of Gilbert White, he was in no proper sense of the word a saint. He was an honest, excellent Englishman, with a "curious" intellect and a generous disposition, but assuredly not more saintly than a thousand others. Mr. Wright says in his preface that "it is permissible to regard him as the patron saint of the little village where he spent the greater part of his life." That is well enough, for it suggests no saintliness; but "Saint Gilbert" is most unhappy. The book consists of 85 small pages, largely made up of quotations from White himself and those who have recently written about him. It will do no harm, and may perhaps do some good; and that is perhaps all that need be said about it. The eight photographs which illustrate it are unusually good, and so are the tail-pieces at the end of the chapters.

*Les Zoocécidies des Plantes d'Europe et du Bassin de la Mediterranée.* Tome i. By C. Houard. Pp. 569; 1365 figures, 2 plates, and 4 portraits. (Paris: Hermann, 1908.) Price for both volumes, 40 francs.

DR. HOUARD deserves congratulation on the successful accomplishment of his task of giving a systematic account of the European galls. Of recent years there has been great activity in the study of galls, which are of equal theoretical and practical interest, and this scholarly and well-arranged catalogue, brought up to date, will be widely welcomed. It is an admirable piece of work. The author gives terse descriptions of

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